EXHIBIT C

UNITED STATES DISTRICT COURT
DISTRICT OF PUERTO RICO

In re: THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, as representative of PUERTO RICO ELECTRIC POWER AUTHORITY Debtor.	PROMESA Title III No. 17-BK-4780-LTS (Jointly Administered)

REBUTTAL REPORT OF GLENN R. GEORGE, MBA, PE, PHD

May 15, 2023

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Abbreviations used in this report

The following is an alphabetized list of abbreviations and defined terms used in this report. If not otherwise defined herein, the abbreviations or defined terms will take the meaning assigned to them in the body of this report, and if not defined therein, in the Modified Second Amended Plan of Adjustment.

AEO— US Energy Information Administration Annual Energy Outlook

CapEx—Capital expenditure(s)

CDBG-DR—Community Development Block Grant-Disaster Recovery

CVI—Contingent value instrument

DG—Distributed generation

EE—Energy efficiency

EV—Electric vehicle

EIA—US Energy Information Administration

FEMA—Federal Emergency Management Agency

FY—Fiscal year

HUD—US Department of Housing and Urban Development

IRP—Integrated Resource Plan

kWh—Kilowatt-hour

OpEx—operating expenditures

PREB—Puerto Rico Energy Bureau

PREPA—Puerto Rico Electric Power Authority

PROMESA—Puerto Rico Oversight, Management, and Economic Stability Act

PV—Photovoltaic, a solar energy technology which produces electricity directly through the photoelectric effect

SOW—Share of wallet, a widely used measure of utility (and electricity) rate affordability

T&D—Transmission and distribution

I. Introduction

I.A. Background

(1) This report supplements my preceding expert report, submitted on April 28, 2023 (hereinafter my "Initial Report" or the "George Initial Report") on behalf of the Financial Oversight and Management Board for Puerto Rico (the "Oversight Board") in connection with the Confirmation Hearing for the Title III Plan of Adjustment of the Puerto Rico Electric Power Authority, or "PREPA" (as it may be amended, modified, or supplemented, the "Plan of Adjustment" or "Plan").

(2) In this report, I respond to certain portions of the expert reports submitted by Dr. Susan Tierney (hereinafter the "Tierney Initial Report") and Dr. Maureen Chakraborty (hereinafter the "Chakraborty Initial Report") on April 28, 2023 on behalf of the Ad Hoc Group of PREPA Bondholders, Assured Guaranty Corp., Assured Guaranty Municipal Corp., and Syncora Guarantee Inc. (the "Bondholders").[1]

(3) Unless stated otherwise, I reaffirm all opinions expressed in my Initial Report. Capitalized terms in my Initial Report shall retain their same meaning unless expressly noted otherwise. A list of additional documents considered or relied upon in the preparation of this report appears at Appendix A.

(4) I reserve the right to express additional opinions, to amend or supplement the opinions in this report, or to provide additional rationale for these opinions as additional documents are produced, transcripts of fact and expert witness depositions become available for my review, and new facts are introduced during discovery and trial. I also reserve the right to express additional opinions in response to any opinions offered by other experts. Finally, if opinions expressed by another expert are not addressed in this report, that should not be construed as either agreement or disagreement on those issues.

I.B. Summary of opinions

(5) In my Initial Report, I opined that (i) the Legacy Charge provides PREPA's creditors with reasonable recoveries on their claims given PREPA's need to continue operations, as well as the burden on ratepayers and the Puerto Rico economy of increased rates; (ii) the methodology used by the

[1] The Bondholders' informative motion submitting the Tierney Initial Report and Chakraborty Initial Report states that they "submit this informative motion submitting Bondholders' redacted Opening Expert Reports with the agreement of U.S. Bank National Association in its capacity as PREPA Bond Trustee." Case No. 17-04780-LTS, Doc. No. 3423, page 1.

Oversight Board to determine the Legacy Charge is appropriate; and (iii) the design of the Legacy Charge is consistent with principles of just and reasonable rates.

(6) This report expands upon the opinions expressed in my Initial Report in response to opinions expressed by Dr. Tierney and Dr. Chakraborty in their respective reports. Dr. Tierney expresses a number of opinions about inputs and assumptions which were used to derive the Legacy Charge. Dr. Chakraborty then relies on the opinions expressed in the Tierney Initial Report (and those of other experts not addressed in this report) in the Chakraborty Initial Report to determine a series of hypothetical revenue ranges which represent the revenue PREPA could potentially raise for the purposes of debt repayment.

(7) In particular, I shall address Dr. Tierney's opinions related to PREPA's net load forecast, the Oversight Board's short- and long-run price elasticity estimates, and PREPA's capital expenditure ("CapEx") requirements—opinions with which I expressly disagree. I shall also address Dr. Chakraborty's opinions related to the 6% "share of wallet" concept as it pertains to high-income residential customers, commercial customers, and industrial customers.

II. Overarching critique of opinions expressed by Dr. Tierney and Dr. Chakraborty

(8) The overarching implication of the opinions expressed by Drs. Tierney and Chakraborty is that more revenue can and should be extracted from PREPA's ratepayers for purposes of debt repayment. Dr. Chakraborty attempts to demonstrate in her report that "PREPA can collect significantly more "Additional Net Revenues" to repay creditors' claims" and that "…the Board has significantly understated the Additional Net Revenues that PREPA can reasonably collect from the implementation of an affordable Legacy Charge…"[2] In effect, what Drs. Tierney and Chakraborty are suggesting is that some of the lowest-income utility customers in the US—who already pay some of the highest rates in the US for the least reliable electric service in the country—should be expected to pay *even more* than the significant rate increase contemplated to pay the Legacy Charge under the Plan of Adjustment, with such monies going to paying legacy debt rather than improving the utility.[3]

(9) Specifically, Dr. Chakraborty claims that somewhere between $8.96 billion and $13.39 billion in Additional Net Revenues might be available for debt repayment, should some or all of Dr. Tierney's and Dr. Chakraborty's suggested modifications to the Legacy Charge derivation be accepted.[4] These amounts represent between a 58% and a 136% increase in Additional Net Revenues over the $5.68 billion proposed through the methodology applied by the Oversight Board. Dr. Chakraborty makes these claims without any discussion of the impact that the rate increases necessary to generate significantly higher Additional Net Revenues could have on PREPA's customers, PREPA's ongoing operation, and on the sustainability of the Legacy Charge and, more broadly, the Fiscal Plan and Plan of Adjustment.

(10) All Drs. Tierney and Chakraborty have demonstrated is that, on paper, there are myriad hypothetical scenarios in which additional revenue theoretically could be extracted from PREPA's customers. However, what they have not successfully demonstrated is an understanding and appreciation that there is more to consider than just these hypothetical math exercises.

(11) Inconceivably, Dr. Tierney and Dr. Chakraborty's one-sided arguments neglect the asymmetric risk associated with over-extracting revenue from PREPA's customers to service the new debt. Maximizing creditor recoveries through increased rates runs the risk of inducing a classic utility "death spiral," and thus future default or insolvency for PREPA: the worst possible outcome for

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2 Expert report of Maureen M. Chakraborty, PhD, April 28, 2023, ¶¶ 23 and 55 [hereinafter "Chakraborty Initial Report"]. I note that Dr. Chakraborty uses the term "Additional Net Revenues" to refer to the incremental revenues available for debt repayment. In my Initial Report, I referred to these as the "Legacy Charge Revenues" and that in this report I may use these two terms interchangeably.

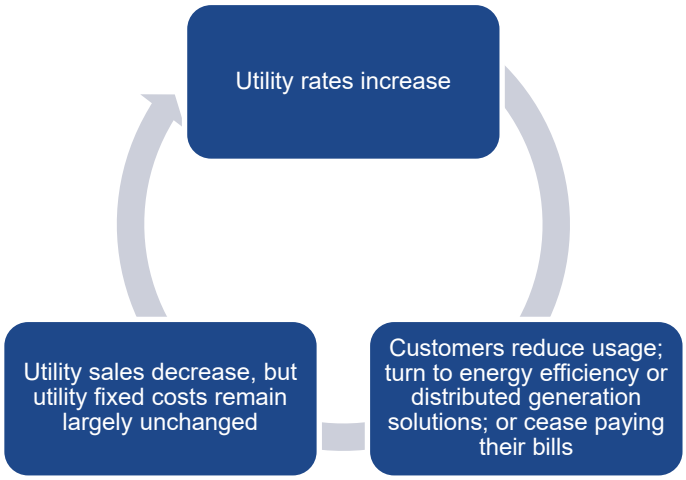
3 Expert report of Glenn R. George, MBA, PE, PhD, April 28, 2023, ¶¶ 16-19, 40 [hereinafter "George Initial Report"].

4 Chakraborty Initial Report, Figure 1.

PREPA, PREPA's customers, and PREPA's creditors, not to mention the broader Island economy.[5] The threat of this type of asymmetric risk cannot be overstated, as outcomes associated with potential over-extraction of revenue from ratepayers are vastly worse than underpaying the creditors.[6]

(12) An increase in utility rates inevitably leads to a loss of net electrical load due to some combination of load defection (reduction of net load through customer adoption of EE and DG technologies) and grid defection (total loss of net load, e.g., through outmigration or "cord-cutting" such as installation of rooftop solar PV combined with enough battery storage to go off-grid altogether).[7] How much net load is lost and how quickly, is a function of the price elasticity of demand for electricity, as discussed at some length in my Initial Report. But *any* loss of net load will, in turn, force the utility to spread its fixed costs across a smaller customer base by levying even higher rates on the remaining customers, since its costs do not decrease proportionally with the reduction in electricity consumed, thus repeating the cycle.[8] **Figure 1** below provides a brief illustration of the utility death spiral concept.

Figure 1: Illustration of the utility death spiral



(13) Dr. Tierney contends that "…the 'Base Case' net load forecast of PREPA's future electricity demand—as reported in the 2022 PREPA Fiscal Plan and that the FOMB uses to calculate its proposed Legacy Charge—greatly underestimates PREPA's future sales of electricity."[9] As noted in

[5] George Initial Report, ¶ 80; Michael Chesser, Jim Hanly, Damien Cassels, and Nicholas Apergis, "The positive feedback cycle in the electricity market: residential solar PV adoption, electricity demand and prices," *Energy Policy* 122 (2018): 36-44, p. 42 [hereinafter "Chesser *et al.,* (2018)"].

[6] Chesser *et al.,* (2018) refers to a similar phenomenon called the "positive feedback cycle," whereby increasing electricity prices is a key contributor to the adoption of solar PV. Chesser *et al.,* (2018), p. 38.

[7] Chesser *et al.,* (2018), p. 37.

[8] Chesser *et al.,* (2018), pp. 41-42.

[9] Expert report of Susan Tierney, PhD, April 28, 2023, ¶ 9 [hereinafter "Tierney Initial Report"]. Relatedly, I note that the load forecast sensitivity analysis that I conducted in Section IV.A of my Initial Report used *gross* load while Dr. Tierney

my Initial Report, I take the PREPA 2022 Fiscal Plan (hereinafter the "2022 Fiscal Plan") as given and I understand PREPA must do so as well.[10] Accordingly, the Base Case forecast appropriately reflects the currently enacted laws and regulations that PREPA must abide by, whereas the Alternative Forecast endorsed by Dr. Tierney does not.[11] Nonetheless, I provide some commentary here regarding Dr. Tierney's critique of the PREPA load forecast, in particular her views on energy efficiency ("EE"), distributed generation ("DG"), and electric vehicles ("EVs").

(14) Regarding EE, Dr. Tierney expresses the opinion that it is unrealistic to believe Puerto Rico will achieve its statutory goal of a 30% load reduction by 2040 relative to 2019 levels through energy efficiency measures.[12] Contrary to Dr. Tierney's claim, it is standard practice, and almost a prerequisite part of any forecast, to assume that policies duly enacted through law or regulation are and will be adhered to. For example, the Energy Information Administration's ("EIA") Annual Energy Outlook ("AEO")—one of the most widely used forecasts in the sector—assumes adherence to all current legislation and environmental regulations.[13] Rather than predicting what *will* happen, the AEO is a modeled projection of what is *likely* to happen given various inputs and assumptions, one of which is that current laws and regulations are not violated.[14] A base-case forecast typically represents the analyst's understanding of the *likeliest* outcome under an agreed set of model inputs.

(15) Accordingly, reliance on PREPA's Alternative Forecast instead of its Base Case forecast, as suggested by Dr. Tierney, would in my view be inappropriate and contrary to standard practice in the world of forecasting, since the Alternative Forecast does not assume duly enacted laws and regulations will be adhered to.[15] Dr. Tierney believes, for example, that it is unrealistic to assume 100% customer adoption of energy efficient non-lighting technologies.[16] Dr. Tierney ignores the fact that customers *must* adopt many energy efficient technologies because non-energy efficient alternatives are no longer available on the market once the relevant regulation has been adopted.[17]

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uses *net* load in her analyses (see Section VI of the Tierney Initial Report). Also, I understand that the historical gross load figures included in the 2022 Fiscal Plan were incorrect, but not materially so, due to a calculation error in the 2022 Fiscal Plan.

10 George Initial Report, ¶ 99.

11 The FOMB notes the Alternative Forecast is "not constrained by Act 17" and "assumes organic growth of [energy efficiency] through incremental year-over-year technology efficiencies without considering legislation or program investments." *See* FOMB – Certified PREPA 2022 Fiscal Plan, June 28, 2022 (FOMB_PREPA 00000699-882), pp. 151-52 [hereinafter "2022 Fiscal Plan"].

12 Tierney Initial Report, ¶ 40.

13 "Summary of Legislation and Regulations Included in the Annual Energy Outlook 2022," US Energy Information Administration, March 2022, https://www.eia.gov/outlooks/aeo/assumptions/pdf/summary.pdf.

14 "EIA's Annual Energy Outlook is a projection, not a prediction," Owen Comstock, US Energy Information Administration, May 17, 2016, https://www.eia.gov/todayinenergy/detail.php?id=26272.

15 Counsel also informs me that PROMESA section 314(b)(7) requires the Plan of Adjustment to be consistent with the PREPA fiscal plan certified by the Oversight Board. The fiscal plan is developed based on the Base Case projections, not the Alternative Forecast. *See* Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA), § 314(b)(7), 48 U.S.C § 2101 (2016), https://www.congress.gov/114/plaws/publ187/PLAW-114publ187.pdf.

16 Tierney Initial Report, ¶ 50.

17 See, e.g., "EESI Fact Sheet: Energy Efficiency Standards for Appliances, Lighting, and Equipment," Environmental and

Similarly, Dr. Tierney ignores recent orders by PREB to implement measures to achieve Act-17 energy efficiency goals.[18]

(16) Regarding DG, Dr. Tierney claims that "PREPA's Base Case net load forecast is further altered unreliably by its assumption that Puerto Rico will make major gains in customers' installation of distributed generation facilities…"[19] However, it appears that Puerto Rico has, by some measure, *already* made significant progress in increasing its residential solar capacity. Since 2015 residential solar capacity has increased by 1,923% and commercial solar capacity increased 185%.[20] More than 54,000 customer connections to rooftop solar have been supported by LUMA in the 21 months since it assumed operations of PREPA's transmission and distribution ("T&D") system, more than tripling the total number of residential solar customers from a decade ago.[21]

(17) As noted in my Initial Report, federal programs designed to make DG alternatives more affordable will lead even more of PREPA's customers to turn to DG and reduce the net electricity purchased from PREPA.[22] Moreover, evidence of the existence of the positive feedback cycle described in Chesser *et al.* (2018) and the importance of the savings (and higher reliability) associated with residential solar PV adoption suggest that further adoption of solar PV systems is likely.[23] Accordingly, I believe it is reasonable to expect increased and perhaps very significant adoption of DG alternatives in Puerto Rico in the coming years and this should be accounted for in the net load forecast.

(18) Regarding EVs, Dr. Tierney's opinions are sharply at odds with her opinions regarding EE and DG. Dr. Tierney is optimistic regarding the pace and depth of EV market penetration in Puerto Rico, whereas (as discussed above) she is pessimistic regarding the uptake of EE and DG on the island. Since EVs have the potential to increase net load, Dr. Tierney sees relatively rapid EV adoption as justification, in part, for preferring PREPA's (higher) Alternative Load Forecast to the Base Case Forecast. But there are reasons to doubt this narrative. First there is the general issue of consistency:

Energy Study Institute, August 2017, https://www.eesi.org/files/FactSheet_Energy_Efficiency_Standards_2017.08.pdf.

18 On February 16, 2023, PREB issued a Resolution and Order (Case No. NEPR-MI-2022-0001) approving a modified Transition Period Plan. The approved Transition Period Plan was further modified addressing LUMA's motion for reconsideration through a Resolution and Order of April 3, 2023. *See* PREB Resolution and Order, "Determination of Luma's June 21, 2022, Proposed Transition Period Plan," Case No. NEPR-MI-2022-0001, February 16, 2023, https://energia.pr.gov/wp-content/uploads/sites/7/2023/02/20230216-MI20220001-Resolution-and-Order.pdf.

19 Tierney Initial Report, ¶ 51.

20 "Chart: Here's how much rooftop solar is surging in Puerto Rico," Maria Gallucci and Maria Virginia Olano, Canary Media, June 10, 2022, https://www.canarymedia.com/articles/solar/chart-heres-how-much-rooftop-solar-is-surging-in-puerto-rico.

21 "Historic Accomplishment: Luma achieves 54,000 solar connections, propelling Puerto Rico to rank seventh in solar energy adoption among U.S. states & territories," Luma press release, April 21, 2023, https://lumapr.com/news/historic-accomplishment-luma-achieves-54000-solar-connections-propelling-puerto-rico-to-rank-seventh-in-solar-energy-adoption-among-u-s-states-territories/?lang=en.

22 George Initial Report, ¶ 52.

23 Qifang Bao *et al.*, "A human-centered design approach to evaluating factors in residential solar PV adoption: A survey of homeowners in California and Massachusetts." *Renewable Energy* 151 (May 2020): 503-513, p. 1.

since many of the same causal factors (including, notably, median household income and the price of electricity) undergird the adoption of all three technologies, one might expect that their uptake would share certain broad characteristics. Second, there are multiple specific reasons to be pessimistic about the pace and depth of EV adoption in Puerto Rico. There is a well-known relationship between household income and EV adoption, with wealthier individuals significantly more likely to buy an EV than lower-income individuals.[24] With median family income significantly lower than in any US state, Puerto Rico would be expected to experience relatively slow and shallow EV adoption. There is also a relationship between higher electricity prices and EV adoption, with higher prices serving as a deterrent to adoption of EVs, which of course consume electricity.[25] With some of the highest electricity rates in the US, Puerto Rico faces a significant headwind from this phenomenon as well. Tesla reportedly charged an eye-watering $0.42 per kilowatt-hour ("kWh") last summer for its (very few) EV chargers in Puerto Rico.[26] In response to PREPA's high rates and low reliability in the face of frequent hurricanes, some 20% of EV charging stations in Puerto Rico are likely to be solar-powered and totally off-grid.[27] Not surprisingly, EV uptake and the spread of EV charging infrastructure in Puerto Rico have been painfully slow, with only 3,210 registrations on the entire Island and an EV penetration rate of 0.12% in 2021, a lower penetration rate than in any US state other than North Dakota and Mississippi.[28] In late 2021, there were only 32 charging stations *in toto* for the Commonwealth's more than three million residents.[29]

(19) In any event, even if one were to accept Dr. Tierney's opinion that the Alternative Forecast is more appropriate than the Base Case Forecast in estimating net load to derive the Legacy Charge, then one must also consider the associated risks of doing so—including potentially sending PREPA into a death spiral. If the Alternative Forecast *overestimates* net load when setting the Legacy Charge, this

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24 Scott Hardman *et al*., "A Perspective on Equity in the Transition to Electric Vehicles," *MIT Science Policy Review*, Vol. 2 (August 30, 2021): 46-54, https://sciencepolicyreview.org/2021/08/equity-transition-electric-vehicles/. The income effect seems to be more dramatic with EV purchases than with adoption of EE or DG.

25 Erich Muehlegger *et al*., "Do Electricity Prices Affect Electric Vehicle Adoption*?," University of California Institute of Transportation Studies*, Report No. UC-ITS-2020-1 (May 2021), https://www.ucits.org/research-project/2020-12/.

26 "Puerto Rico Included in Federal Electric Vehicle Infrastructure Program," Michele Kantrow-Vázquez, News is My Business, July 11, 2022, https://newsismybusiness.com/puerto-rico-included-in-federal-electric-vehicle-infrastructure-program/.

27 "First Off-Grid Solar-Powered EV Charger Deployed in Puerto Rico in Wake of Rising Natural Disasters," Peter Johnson, Electrek, November 22, 2022, https://electrek.co/2022/11/22/first-off-grid-solar-powered-ev-chargers-deployed-in-puerto-rico/.

28 "LUMA's Proposed EV Infrastructure Is Subject of Hearing before PREB Today," *San Juan Daily Star*, June 15, 2022, https://www.sanjuandailystar.com/post/luma-s-proposed-ev-infrastructure-is-subject-of-hearing-before-preb-today#:~:text=In%202021%2C%20the%20number%20of,%25%2C%20according%20to%20the%20document; "Motion to Submit Final Phase I EV Plan in Compliance with Resolution and Order of January 13, 2023," Case No. NEPR-MI-2021-0013, May 1, 2023, https://energia.pr.gov/wp-content/uploads/sites/7/2023/05/20230501-Motion-to-Submit-Final-Phase-I-EV-Plan-in-Compliance-with-Resolution-and-Order-of-January-132023.pdf.

29 "Puerto Rico: Number of Connectors at Electric Vehicle Charging Stations by Type 2021," Mathilde Carlier, Statista, October 10, 2022, https://www.statista.com/statistics/1176544/types-electric-vehicle-charging-station-connectors-puerto-rico/#:~:text=As%20of%20October%202021%2C%20the,26%20registered%20throughout%20the%20territory.

would result in a *larger* Revenue Envelope and Legacy Charge, all else equal.[30] However, because actual net load would be lower than the overestimated net load, PREPA would be unable to meet its revenue requirement. This, in turn, would result in additional rate increases, as PREPA attempted to meet its revenue requirements while simultaneously servicing its debt at a higher cost imposed by overestimating load. Other factors—including, for example, higher than anticipated oil and gas prices, which get passed through to consumers in their bundled rate—could also contribute to lower than anticipated load and revenue. These factors increase the risk of further customer defection, additional loss of load, and potentially insurmountable difficulties in maintaining PREPA's operations and servicing its debt. Accordingly, relying on the Base Case net load forecast is an appropriately balanced and cautious approach to ensure PREPA does not simultaneously overestimate the revenues available and its ability to repay its creditors over the next 35 years.

(20) On the other hand, if PREPA's Base Case net load forecast is used and it *underestimates* net load in setting the Legacy Charge, this would result in a *smaller* Revenue Envelope and Legacy Charge, all else equal. PREPA could, however, meet its revenue requirement and service its legacy debt without having to raise rates further. It could pay off the new debt more quickly than the projected 35 years and would share the benefits of the additional revenues with creditors through the contingent valuation instrument ("CVI").

[30] This is the case because overestimating the net load would result, *ceteris paribus*, in a greater quantity of electricity being sold and, since revenue equals load times rate, the Revenue Envelope would be larger, in turn allowing a higher Legacy Charge.

III. The rate structure implied by Dr. Chakraborty is impractical, violates the principles of just and reasonable rates, and if implemented could potentially put PREPA into a "death spiral"

III.A. Dr. Chakraborty misunderstands the intention of the 6% share of wallet affordability constraint and its implementation

(21) As a preliminary comment, I would note that neither Dr. Tierney nor Dr. Chakraborty attempts to address the hard question of affordability, and instead takes the Oversight Board construct—which carefully balances a variety of factors—and modifies certain assumptions to show that on paper the Legacy Charge can be increased.

(22) In her Initial Report, Dr. Chakraborty states the following:

> While the Hypothetical Residential Customer is constructed as a median residential customer, it is not representative of the residential customers who will actually pay the Legacy Charge. The Hypothetical Residential Customer's annual income of $24,000 is the Board's estimate of the median household income in Puerto Rico in 2024. Therefore, based on the definition of the "median," approximately 50% of residential customers (or 46% of all PREPA customers) will have incomes higher than $24,000. It is logical that *customers with higher incomes can afford to pay more, yet the Board does not assess the affordable rate for households earning above $24,000 and rather proposes that all residential customers pay the same rates* the Board deems are affordable to the Hypothetical Residential Customer. For example, notwithstanding the fact that higher income customers would be more likely to pay the higher volumetric rate for consumption over 500 kWh/month, these customers are paying much less than 6% of income for electricity.[31]

(23) Dr. Tierney appears to misunderstand the purpose of the 6% share of wallet the Oversight Board used a hypothetical residential customer earning $24,000 per year, consuming 425 kWh per month (based on extensive analysis of numerous sources on power consumption in Puerto Rico) and spending up to 6% of his or her monthly income on electricity as its benchmark to determine a Legacy Charge which would be at the *upper limit of affordability for its more vulnerable customers*, especially unsubsidized low-income customers.[32] The Oversight Board then scaled the fixed and volumetric charges of its non-residential customer classes in a proportional manner to the change in rates for the residential customers.

(24) I understand it was not the Oversight Board's intention to charge up to 6% of *every* customer's monthly income for electricity services, since doing so would be (in my view) impractical, violate the

[31] Chakraborty Initial Report, ¶ 61, p. 39 (emphasis added).

[32] For additional detail, *see* George Initial Report, Section III.A.1.

principle of just and reasonable rates, and endanger PREPA's financial stability. The effect of inflation over time is, *inter alia*, to return the full schedule of rates to the affordability which is statutorily prescribed for PREPA and which ensures feasibility of the Legacy Charge.[33] In early years, some unsubsidized low-income customers will pay more than 6% of their share of wallet, while some higher-income customers will pay less than 6%, but the intended trend over time (through a Legacy Charge which does not rise with inflation) is toward greater affordability for all residential customers. Moreover, the proportional adjustment of the non-residential customer classes keeps the Legacy Charge derivation linked to the relative cost of service for each customer class and does not price discriminate within any rate class.[34]

III.B. Dr. Chakraborty's implication to extract the maximum share of wallet up to the 6% threshold for each customer class is wholly impractical

(25) Dr. Chakraborty implies that PREPA should charge each of its customers based on their ability to pay. Dr. Chakraborty states that "[i]t is logical that [residential] customers with higher incomes *can afford to pay more*…" and "…determination of rates based on a 6% wallet calculation for the Hypothetical Residential Customer has no logical connection to what commercial, industrial, government, and municipal customers *can afford to pay for electricity*."[35]

(26) These statements appear to suggest that a preferred rate design would extract a 6% share of wallet from *each customer* in order to provide more funds to service the New Bonds. This would imply that every residential customer would see a *unique* Legacy Charge in his or her own electricity bill. One implication of such a proposal is that PREPA must update the Legacy Charge at a regular interval based on some affordability metric for each individual customer (e.g., income for residential customers and total operating costs or profit margins for commercial and industrial customers). Presumably, the charges would vary as individual residential customers' household income changed over time. A Legacy Charge that is tied to an income or other affordability metric would in effect result in a *variable* Legacy Charge. PREPA would also need regularly to obtain and assess customers' financial information (such as tax returns) to determine an individual's Legacy Charge. This creates myriad monitoring and implementation difficulties, opens up numerous ways to "game the system,"

[33] Act No. 17-2019, the Puerto Rico Energy Public Policy Act, prescribes electric rates which are "*affordable*, just, reasonable, and nondiscriminatory." (Emphasis added.) The Act also calls for charges which are kept "as close as possible to the twenty cent ($0.20) per kilowatt-hour goal established [for PREPA]…" I note too that keeping the Legacy Charge fixed as revenue rises with inflation provides the "headroom" needed for unforeseen needs, such as natural disasters, CapEx requirements, and the fuel adder. *See* Puerto Rico Energy Public Policy Act No. 17, Commowealth of Puerto Rico, April 11, 2019 [hereinafter "Act No. 17-2019").

[34] The Legacy Charge adjustments for non-residential classes were largely proportional, but also allow for certain discretionary adjustments by the Oversight Board to accommodate price elasticity and affordability concerns. *See* George Initial Report, Section III.B.

[35] Chakraborty Initial Report, ¶¶ 61 and 65 (emphasis added).

and could lead to suboptimal results if an individual's financial circumstances changed (e.g., through unemployment).[36] In my view, such an approach would be nonsensical, difficult to administer, and is obviously not standard practice in utility ratemaking.

(27) For commercial and industrial customers, Dr. Chakraborty suggests that the share of electricity costs relative to total operating costs is low and therefore concludes that these customers could afford to pay more. This is a *non sequitur*, since affordability for commercial and industrial customers is determined not by electricity cost relative to total operating cost, but by electricity cost relative to profit margin. For some commercial and industrial customers, even a small increase in input prices (e.g., electricity) could have a material effect on their profitability. This could spell financial ruin for these commercial and industrial customers if they cannot absorb the higher electricity cost and must increase the price of *their* product to *their* customers, who in turn may opt to purchase from a competitor at a lower price.

(28) Moreover, Dr. Chakraborty ignores the significant financial headwinds which commercial and industrial customers in Puerto Rico face. Such headwinds include, for example, costs associated with shipping inputs to Puerto Rico pursuant to cabotage provisions of the Jones Act of 1920, as well as the phaseout in the decade leading up to 2006 of corporate income tax breaks available to Puerto Rico-based operations pursuant to Section 936 of the Internal Revenue Code.

III.C. Even if Dr. Chakraborty's variable Legacy Charge were practicable, it would result in rates that are no longer just and reasonable

(29) Setting the Legacy Charge based on the premise of extracting the maximum amount that each customer can afford to pay would not yield rates which are just and reasonable, as discussed in Section III.C of my Initial Report. The approach that Dr. Chakraborty appears to propose would result in rates which are untethered to the cost of service. The linkage between customer rates and cost of service is a core tenet of just and reasonable rates. Two of the attributes of a sound rate structure, discussed in my Initial Report, are that (i) rates should apportion the total cost of service fairly among different customers and (ii) rates should avoid "undue discrimination."[37] Setting rates based on each individual customer's ability to pay violates these and other principles of just and reasonable rates.

(30) Indeed, Dr. Chakraborty's implied rate scheme to extract more revenue from only certain customers, not entire customer classes, would appear to violate Act No. 17-2019 (the Puerto Rico Energy Public

[36] For example, households could achieve a lower electric bill by putting it in the name of an individual with the lowest income.

[37] James C. Bonbright, *Principles of Public Utility Rates* (NY, Columbia University Press, 1961), p. 291.

Policy Act). PREPA has a legal requirement to provide electric power service at rates which are "…affordable, just, reasonable, and *non-discriminatory for all consumers* in Puerto Rico."[38]

III.D. Even if Dr. Chakraborty's variable Legacy Charge were practicable and just and reasonable (which it is not), extracting the maximum amount of revenue possible from each customer class is unsustainable

(31) Dr. Chakraborty singles out high-income residential customers as an example of a customer sub-class which can afford to pay a higher Legacy Charge, but the implication that more money can and should be extracted from all customer classes would disproportionately affect non-exempt low-income residential customers. Neither Dr. Tierney nor Dr. Chakraborty addresses the potential hardship for residential customers who are below the estimated median income of $24,000 and who are not exempt from the Legacy Charge, who would end up paying more than 6% of their monthly income on electricity.

(32) The continual adjustment of rates such that PREPA extracts the maximum amount of revenue for debt repayment that is deemed affordable would put PREPA in a precarious position which could threaten its ability to continue operations. PREPA would have little flexibility to increase rates in response to future natural disasters, respond to fuel price fluctuations, invest in new generation or T&D assets, or implement upgrades to improve system resiliency and reliability. The limited ability to raise rates would similarly constrain PREPA's ability to raise new debt to finance these same costs. Such behavior by a utility would not be prudent. I am unaware of any utility which operates without leaving some margin for unexpected expenditures.

(33) Moreover, charging rates which are at the upper bound of affordability for all PREPA customers would increase the likelihood of grid defection due to the price elasticity of demand. Again, multiple states and public utility commissions in the US define 6% as a "high energy burden" and strive to keep energy costs *materially below* 6%, not *at* 6%, for affordability purposes.[39] Higher-income customers are of course well-positioned to avoid higher volumetric charges, such as those suggested by Dr. Chakraborty, by installing some combination of rooftop solar photovoltaic ("PV") and battery storage. From a commonsense perspective, if a doctor or an engineer who earns, say, $100,000 a year were hit with an annual "energy tax" of $6,000, how long would it be until he or she went totally off-grid or simply left Puerto Rico?[40] The risk of grid defection over time would be very real indeed.

[38] Act No. 17-2019, Section 1.5. Emphasis added.

[39] George Initial Report, ¶¶ 39-40.

[40] I note here that the population of Puerto Rico has dropped from 3.8 million to 3.3 million over the past two decades.

IV. The critique offered by Drs. Tierney and Chakraborty of the Oversight Board's selected price elasticities of demand for electricity is unconvincing

(34) Price elasticity of demand is the well-established relationship between changes in price and changes in demand, with an increase in price typically associated with a reduction in demand. In its derivation of the Legacy Charge, the Oversight Board—appropriately, in my opinion[41]—takes the price elasticity of demand for electricity into account in its calculation of the Legacy Charge.

(35) Basic economics tells us that price elasticity is higher (in absolute value terms) for products with close substitutes. Indeed, perfect substitutes have an *infinite* price elasticity of demand. In other words, for a commodity, even a small increase in one supplier's price decreases demand for that supplier's product to zero. Electricity is, at its core, such a commodity. Thus, one can expect the price elasticity of demand for utility-supplied electric power to increase (again, in absolute value terms) as non-utility substitutes (such as rooftop solar PV, battery storage, and other technologies) become more readily available and economically attractive. In my opinion, this process is unfolding now in the electric utility sector and will continue to do so in the coming decades.

(36) The literature regarding the price elasticity of demand for electric power is relatively sparse for several reasons. Among these reasons is that most utility companies historically were franchise monopolies or even (as with PREPA) state-owned, relatively indifferent to consumer choice. Nonetheless, as discussed below, there are multiple plausible estimates of the price elasticity of demand for electricity which could be applied in an analysis of the impact of rate increases on future demand for utility-provided electricity.

(37) Dr. Tierney opines that the Oversight Board's estimates of the price elasticity of demand are "unreasonable, inconsistent with the academic literature on elasticity, and unsupported by PREPA's own prior load-forecasting assumptions."[42] I disagree.

IV.A. The elasticity estimates used to derive the Legacy Charge appropriately rely on the most recent studies and are within the range suggested by the literature

(38) With respect to the short-run elasticity estimate, Dr. Tierney states that the Oversight Board "does not provide any supporting documents related to its assumption of the same short-term elasticity of -0.20

[41] George Initial Report, Sections III.A.2.b and IV.A.

[42] Tierney Initial Report, ¶ 76.

across all customer classes."[43] This is incorrect. **Table 1** below illustrates that the -0.20 short-run price elasticity estimate used for all PREPA customer classes is well within the range of the Burke and Abayasekara (2018) and Buchsbaum (2022) estimates cited by the Oversight Board, as well as the estimates from the Zhu *et al.* (2018) and Labandeira *et al.* (2017) meta-analyses that are preferred by Dr. Tierney. While not every study reports the short-run elasticity by customer class, the ranges provided are indicative that -0.20 is a representative estimate among residential, commercial, and industrial customers. This is demonstrated in the Labendeira *et al.* meta-analysis, which does distinguish among residential, commercial, and industrial customers.

Table 1: The Legacy Charge short-run elasticity estimate is well within the range of short-run elasticity estimates proposed in the studies referenced by both Dr. Tierney and the Oversight Board[44]

Customer category	Burke and Abayasekara (2018)	Labandeira *et al.* (2017)	FOMB Legacy Charge Derivation	Zhu *et al.* (2018)	Buchsbaum (2022)
Residential	-0.10	-0.19	-0.20	-0.23	-0.36
Commercial		-0.21		–	–
Industrial		-0.15		–	–

(39) Moreover, in the context of the broader literature on the price elasticity demand for electricity, as discussed at length in my Initial Report, **Table 2** below shows that the Oversight Board's short-run elasticity estimate of -0.20 specifically for residential customers is consistent with the literature.

Table 2: Expanded literature review of short-run elasticity for residential customers[45]

Price elasticity of demand study	Short-run price elasticity
Alberini and Filippini (2011)	-0.10
Burke and Abayasekara (2018)	-0.10
Sun and Yu (2017)	-0.10
EIA (2021)	-0.13
Deryugina *et al.* (2017)	-0.14
FOMB Legacy Charge Derivation	**-0.20**
Labandeira *et al.* (2017)	-0.20
Zhu *et al.* (2018)	-0.23
Buchsbaum (2022)	-0.36

(40) To support her opinion that the long-term price elasticity estimates used to derive the Legacy Charge "overstate the amount of demand reduction that new rate increases would cause" and thus "understate the amount of PREPA's available Revenue Envelope that could be devoted to debt service," Dr.

[43] Tierney Initial Report, ¶ 86.

[44] Tierney Initial Report, Appendix F.

[45] George Initial Report, Section III.A.2.a. and Table 2.

Tierney relies on two meta-analyses, Zhu *et al.* (2018) and Labandeira *et al.* (2017).[46] Zhu *et al.* (2018) analyzed studies with data that *covered* 1950 to 2014 globally, while Labandeira *et al.* (2017) considered studies which were *published* between 1990 and 2016 and thus relied on data from even before that range of years (also globally).[47]

(41) I disagree with Dr. Tierney's opinions. As described in my Initial Report, these two meta-analyses were conducted during a period in which the availability and affordability of DG solutions—such as rooftop solar PV coupled with battery storage—were vastly lower than in more recent years.[48] Since the meta-analyses were conducted, I believe the increasing affordability, availability, and prevalence of rooftop solar PV adoption, including battery storage, strongly suggest a significantly higher and increasing long-run price elasticity of demand for electricity. For example, the Tesla Powerwall (a small-scale battery storage system) became commercially available only in 2016, and it is currently achieving significant market penetration in Puerto Rico and other markets.[49] To cite another example, a company called OhmGrid only last year began offering a product whereby a residential electric utility customer could completely "cut the cord" with his or her electric utility company by installing a combination of solar PV, battery storage, and generators.[50]

(42) Such new products and services are, in my opinion, already significantly increasing the price elasticity of demand for electricity, particularly in the long-run. This higher long-run price elasticity of demand, in turn, helps create and sustain a positive feedback cycle whereby residential customers react to higher electricity prices by adopting DG systems (especially solar PV plus storage), thereby reducing their net electricity purchases from the grid, thus leading utilities to increase rates in response as fixed costs are no longer adequately covered, which in turn feeds back on itself.[51] This phenomenon—accelerated by the increasing availability and affordability of DG systems—lies at the heart of the utility "death spiral" described above and in my Initial Report.[52]

(43) Moreover, as noted in my Initial Report, the Burke and Abayasekara (2018) and Buchsbaum (2022) studies appear to be reliable because of their recency and their representative geography, since they cover the lower 48 US states and northern and central California, respectively, among other reasons.[53] In addition to these two papers, I believe the Chesser *et al*. (2018) study, which finds a long run price

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46 Tierney Initial Report, ¶ 93.

47 *See* Xing Zhu *et al.*, "A meta-analysis on the price elasticity and income elasticity of residential electricity demand," *Journal of Cleaner Production* 201 (2018): 169-177, p. 2; *see also* Xavier Labandeira *et al.*, "A meta-analysis on the price elasticity of energy demand," *Energy Policy* 102 (January 2017): 549-568, p. 3.

48 George Initial Report, ¶ 47.

49 "Tesla Powerwall powered 44,000 homes in Puerto Rico during latest grid outage," Fred Lambert, Electrek, October 27, 2022, https://electrek.co/2022/10/27/tesla-powerwall-powered-44000-homes-puerto-rico-grid-outage/.

50 See https://www.ohmgrid.com/.

51 Chesser *et al.,* (2018) pp. 41-42.

52 George Initial Report, ¶ 80.

53 George Initial Report, ¶ 48.

elasticity of demand of -3.55, to be reliable. Notably, Chesser *et al.* (2018) find that an increase in electricity price "…will significantly increase solar PV uptake…"[54] This supports the positive feedback cycle theory, according to which higher electricity prices lead to an increase in installations of residential solar PV systems.[55]

(44) Dr. Tierney suggests that the Oversight Board's "…long-term elasticity estimates are out of line with [the Zhu *et al.* (2018) and Labandeira *et al.* (2017) estimates] and other results…"[56] However, as shown in **Table 3** below, the long-run elasticity for residential customers estimated by the Oversight Board falls squarely within the range of long-run residential elasticity estimates documented in the literature. Indeed, it is conservative when compared with the Buchsbaum (2022) and Chesser *et al.* (2018) estimates.

Table 3: The Oversight Board's Legacy Charge long-run elasticity estimate for residential customers is within the range of the estimates reported in the literature[57]

Price elasticity of demand study	LR price elasticity
Deryugina *et al.* (2017)	-0.29
Ros (2017)	-0.40
EIA (2021)	-0.50
Labandeira *et al.* (2017)	-0.51
Zhu *et al.* (2018)	-0.58
Alberini and Filippini (2011)	-0.70
Burke and Abayasekara (2018)	-0.95
Sun and Yu (2017)	-1.00
Feehan (2018)	-1.20
FOMB Legacy Charge Derivation	**-1.70**
Buchsbaum (2022)	-2.35
Chesser *et al* (2018)	-3.55

(45) In my opinion, Puerto Rico should fall at the high end (in absolute value terms) of the range of estimates of the price elasticity of demand for electricity, for three reasons: high electricity prices, low system reliability, and a desirable geographic location (with high insolation) from the perspective of effective substitution (of solar PV, especially when combined with battery storage for enhanced reliability). Despite carping by Drs. Tierney and Chakraborty, the Oversight Board is well-justified in the price elasticities of demand used in deriving the Legacy Charge.

54 Chesser *et al.,* (2018), p. 39.

55 Chesser et al., (2018), p. 39.

56 Tierney Initial Report, ¶ 95.

57 George Initial Report, Table 2 and Chesser *et al.,* (2018), p. 41.

IV.B. Dr. Tierney distorts the implications of the Burke and Abayasekara (2018) and Buchsbaum (2022) studies

(46) Dr. Tierney appears to focus on the specific *drivers* of the price elasticity of demand estimates (e.g., rooftop solar PV, battery storage, more affordable diesel or gasoline-powered backup generators, more energy efficient lighting and appliances), rather than the overall *effect*. In fact, both the Burke and Abayasekara (2018) and Buchsbaum (2022) studies show a very substantial price elasticity of demand for electricity at a statistically significant level. Dr. Tierney states that "[the Oversight Board] is mistaken that the Buchsbaum (2022) estimate of higher long-run elasticity for PG&E residential customers is premised on those customers' ability to adopt solar PV systems."[58] Although Buchsbaum (2022), whose long-run elasticity result is -2.35, does not endorse solar or EE programs as "mechanisms driving the observed long-run elasticities," other studies clearly find such a link.[59] For example, Chesser *et al*. (2018) not only finds a long-run residential price elasticity of demand for electricity of -3.55—significantly higher (in absolute value terms) than any elasticity used by the Oversight Board—but explicitly finds that a 1% increase in electricity price will boost residential solar PV uptake by 0.55%.[60] The Oversight Board was justified in considering residential solar PV adoption an important contributing factor in the price elasticity of demand for electricity.

(47) However, what ultimately is of interest in setting the Legacy Charge is the *aggregate* price elasticity and not the specific DG or EE technologies that contribute to it. Indeed, there are a number of factors which play into the price elasticity estimate, including but not limited to consumers' preferences, choices, and finances with respect to DG and EE. The use of the label "solar," as is done in the Excel workbook used to estimate the long-run elasticities, appears to be merely a shorthand reference to the myriad DG and EE technologies and behaviors which have become more prevalent and economical in recent years and serve *incrementally* to increase the price elasticity of demand (in absolute-value terms) beyond that which was observed in prior years.[61] The important conclusion which should be drawn from both the Burke and Abayasekara (2018) and Buchsbaum (2022) studies is that the long-term price elasticities of demand used to derive the Legacy Charge must be set higher (again, in absolute value terms) than those suggested in such studies as Labandeira *et al.* (2017) and Sun and Yu (2017).[62] The specific underlying cause of the demand shift is a subsidiary issue.

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58 Tierney Initial Report, ¶ 89.

59 Jesse Buchsbaum, "Long-run price elasticities and mechanisms: Empirical evidence from residential electricity customers," PhD job market paper, University of California, Berkeley, October 2022 (FOMB_PREPA 00022518-89), p. 36.

60 Chesser *et al*., (2018), pp. 39-41.

61 *See* "LT Elasticity workbook.xlsx" (FOMB_PREPA 00022590).

62 Xavier Labandeira *et al.,* "A meta-analysis on the price elasticity of energy demand," *Energy Policy* 102 (January 2017), pp. 549-68 and Yanming Sun and Yihua Yu, "Revisiting the Residential Electricity Demand in the United States: A Dynamic Partial Adjustment Modelling Approach," *Social Science Journal*, 54, no. 3 (2017), pp. 295-304.

IV.C. Dr. Tierney makes misleading references to PREPA's 2019 IRP related to the price elasticity of demand for electricity in Puerto Rico

(48) Dr. Tierney states that "'customer rates were considered' as a potential explanatory (independent) variable in the [Integrated Resource Plan's ("IRP")] analysis, 'but they were found not to have a strong historic correlation to demand and explanatory power.'"[63] This is an incomplete and misleading extract from the IRP. The 2019 IRP makes this statement with respect primarily to industrial rates.[64] In fact, when that section of the IRP is considered in its entirety, it supports the Oversight Board's own estimates of long-run elasticities for industrial customers, which were assigned some of the lowest long-run values and incremental elasticity factors among PREPA's customer classes.[65]

(49) Dr. Tierney also quotes from the 2019 IRP in an attempt to support the notion that residential and commercial customers' demand for electricity in Puerto Rico is somehow *inelastic*. She states that "[t]he residential sector…is traditionally a sector with low response to changes in retail rates and to some exten[t] the commercial customers."[66] Again, this is an incomplete and misleading quotation. The very next sentence in the 2019 IRP states that, "[h]owever, sustained high retail rates could change customer behavior and create more incentives for implementation of energy efficiency programs."[67] In my opinion, this correctly captures the concept of price elasticity of demand: customers are typically more responsive to price increases which are sustained over longer periods of time because this gives them the opportunity to identify and adopt substitutes. The Legacy Charge, which is proposed to be in effect for 35 years or more, is an apt example of such a "sustained high retail rate." As such, the long-run price elasticity of demand for electricity both reflects and results in increased implementation of EE and DG solutions, over time, across PREPA's customer classes.

63 Tierney Initial Report, ¶ 97.

64 IRP2019 - Ex 1.00 - Main Report REV2, June 7, 2019 (FOMB_PREPA 00024202), Section 3, p. 3-5.

65 *See* George Initial Report, Table 3; *See also* "LT Elasticity workbook.xlsx" (FOMB_PREPA 00022590).

66 Tierney Initial Report, ¶ 98.

67 IRP2019 - Ex 1.00 - Main Report REV2, June 7, 2019 (FOMB_PREPA 00024202), Section 3, p. 3-5.

V. There is strong evidence that PREPA's CapEx requirements significantly exceed those included in the 2022 Fiscal Plan

V.A. PREPA has historically underinvested in generation and T&D CapEx

(50) Dr. Tierney contends that the Oversight Board "…overstates future capital expenditures…" in its derivation of the Legacy Charge and that "…there is no sound basis on which the FOMB's Legacy Charge Derivation reserves future additional revenue capacity…"[68] Dr. Tierney does not, however, take stock of the parlous state of PREPA's generation and T&D assets nor acknowledge PREPA's persistent CapEx underfunding.

(51) There are numerous indicators which demonstrate that PREPA has continually underinvested in CapEx. Among them are PREPA's inability to provide reliable service to its customers as a result of (and demonstrated by) the frequent and often sustained system outages, aging electricity generation assets, and declining year-over-year investment from fiscal year ("FY") 2010-2016.[69] Indeed, the 2017 Fiscal Plan specifically noted that "[y]ears of underinvestment have led to severe degradation of [generation and T&D] infrastructure."[70]

(52) Another such indicator is that depreciation of PREPA's generation and T&D assets in recent years has routinely exceeded its CapEx, as shown in **Table 4** below. (One would normally expect CapEx in any given year significantly to exceed depreciation in that year because CapEx reflects ongoing investment in capital assets at current prices whereas depreciation reflects past investments in capital assets as much lower then-year prices.)

[68] Tierney Initial Report, ¶¶ 101 and 115.

[69] George Initial Report, Section II.B. and Section III.A.3.a.

[70] PREPA 2017 Fiscal Plan, April 28, 2017, p. 12. https://oversightboard.pr.gov/fiscal-plans-2/.

Table 4: Historical annual additions to depreciation and CapEx for PREPA's generation and T&D assets ($ in millions)[71]

Fiscal Year	Total additions to depreciation	Total CapEx
2017	$452.67	$148.85
2018	$283.97	$95.33
2019	$310.23	$207.38
2020	$297.66	$173.48

(53) The significant gap between PREPA's annual CapEx investments and its annual depreciation is further evidence of PREPA's consistent underinvestment in its generation and T&D systems. In my opinion, this represents clear evidence of insufficient investments being made in upgrading and replacing PREPA's assets.

(54) Dr. Tierney does, however, acknowledge that if PREPA is to abide by established EE and DG policies, it must "…make significant investments in its grid infrastructure…"[72] I agree with Dr. Tierney in this respect. PREPA's need for additional investment above and beyond what has been included in the annual fiscal plans—and thus even more in excess of LUMA's projected CapEx spending as escribed in the Tierney Initial Report—is well documented. Similarly, in December 2022, the US Department of Housing and Urban Development ("HUD") identified nearly $5.2 billion in unmet CapEx needs *above and beyond* the available federal funds for LUMA and PREPA.[73]

(55) Separately, one of the Oversight Board's advisors, McKinsey & Company, has performed a T&D CapEx benchmarking analysis of PREPA against 15 comparable electric utilities in the southeastern US. The McKinsey study tells a similar story of sustained underinvestment by PREPA. There is a stark contrast between the average T&D CapEx spend of comparable utilities over the past decade with PREPA's T&D CapEx investment in the same period. The average annual T&D CapEx spend from 2010-2019 for the comparable utilities was nearly $500 million, while PREPA's was less than $90 million.[74]

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[71] PREPA Fiscal Plan Model v06.29.2022 vSHARE.xlsx", (FOMB_PREPA 00024561); PREPA Financial Statements, Required Supplementary Information, and Supplemental Schedules (2017), p. 35; PREPA Financial Statements, Required Supplementary Information, and Supplemental Schedules (2018), Note 8; PREPA Financial Statements, Required Supplementary Information, and Supplemental Schedules (2019), Note 8; PREPA Financial Statements, Required Supplementary Information, and Supplemental Schedules (2020), Note 8; and PREPA Financial Statements, Required Supplementary Information, and Supplemental Schedules (2021), Note 8.

[72] Tierney Initial Report, ¶ 60.

[73] "Puerto Rico Disaster Recovery Action Plan," HUD, April 21, 2023, https://cdbg-dr.pr.gov/en/download/cdbg-dr-action-plan-for-the-electrical-systems-enhancements-effective-on-march-25-2022/?ind=1648758532100&filename=2022%2003%2025_ADM_POLI_Action%20Plan_Energy%20Action%20Plan%20Draft.pdf&wpdmdl=25442&refresh=627c0f6e213681652297582, p. 77.

[74] McKinsey & Company, "20230512 Utility Benchmark PREPA CapEx.xlsx." Note that only data for FY 2017 and 2019-2021 were used to calculate PREPA's average annual T&D CapEx spend. Data was not readily available for prior years and FY 2018 is excluded as an outlier due to Hurricane Maria.

(56) As part of its benchmarking study, McKinsey performed a regression analysis using data from PREPA and the set of 15 comparable utilities to estimate what each utility's *predicted* (or modeled) annual T&D CapEx spend would be in 2022, based on prior years' CapEx spending, transmission network length, number of customers, and electric energy delivered.[75] PREPA's modeled annual T&D CapEx requirement is at least $250 million, or about 65% more than PREPA's actual average annual spend. This $250 million *per annum* is the amount that the Oversight Board uses in the Revenue Envelope Model to estimate future T&D CapEx needs.

V.B. It is prudent for PREPA to account for CapEx needs that have been identified since approval of the 2022 Fiscal Plan

(57) Dr. Tierney contends that there is no evidence to support the need for $50 million in additional annual CapEx from FY 2024 through 2033 for PREPA's local-cost share portion of Federal Emergency Management Agency ("FEMA") funds to be provided under FEMA PA 428.[76] However, I understand that evidence in the record does indeed support this additional CapEx requirement.

(58) To access the approximately $10 billion in FEMA funding from fiscal years 2024 through 2033, PREPA must provide a 10% local cost-share, amounting to approximately $1 billion (total) over 10 years.[77] While PREPA has assumed that the 10% local cost-share of the Global Settlement would be funded by the HUD's Community Development Block Grant-Disaster Recovery ("CDBG-DR") Program, in the 2022 PREPA Fiscal Plan only $500 million for local cost-share has been approved.[78] Therefore, PREPA must identify the source of funds needed to cover the remaining half of the 10% cost-share requirement (which is approximately $500 million). The Revenue Envelope and Legacy Charge account for this via the additional $50 million annual CapEx from FY 2024 through 2033, assuming equal annual amounts over ten years.

(59) As a general matter, the 2022 Fiscal Plan contemplates limited future CapEx spending from FY 2022 onwards, with that limited spending focused on required maintenance rather than necessary improvements given the poor state of the system. I understand that, while PREPA is in bankruptcy, LUMA must comply with the 2022 Fiscal Plan by restricting CapEx to necessary maintenance only and to spend within the approved rate case, rather than what may actually be needed. Accordingly,

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75 The regression inputs included medium voltage T&D circuit length, number of customers, and total load in 2021. *See* McKinsey & Company, "20230512 Utility Benchmark PREPA CapEx.xlsx."

76 Tierney Initial Report, ¶ 111.

77 2022 Fiscal Plan, p. 90.

78 2022 Fiscal Plan, p. 90; "Puerto Rico Disaster Recovery Action Plan," HUD, April 21, 2023, https://cdbg-dr.pr.gov/en/download/cdbg-dr-action-plan-for-the-electrical-systems-enhancements-effective-on-march-25-2022/?ind=1648758532100&filename=2022%2003%2025_ADM_POLI_Action%20Plan_Energy%20Action%20Plan%20Draft.pdf&wpdmdl=25442&refresh=627c0f6e213681652297582, p. 113.

LUMA's CapEx estimates assume PREPA will remain in bankruptcy and PREPA will not have access to additional funding through increased rates or external financing through the capital markets.

(60) Since May 2021, PREPA has submitted two budget amendments to reallocate funds in its FY 2022 budget between non-federally funded CapEx and operating expenditures ("OpEx"). The net effect of these amendments was the reallocation of approximately $26 million from the non-federally funded CapEx budget to the OpEx budget (a 21% reduction in the non-federally funded CapEx budget).[79] LUMA noted that this reallocation was necessary due to a backlog of necessary OpEx for repairs and maintenance that was inherited when LUMA commenced operations, such as repair of significantly more non-functioning electrical assets and equipment than anticipated, damaged and inoperable facilities, and problems with operation of the outage management and asset management systems.[80] Thus, LUMA's forecast of CapEx as cited in the Tierney Report is restricted by the 2022 Fiscal Plan and further constrained by the need for LUMA to reallocate CapEx funding to OpEx. In other words, LUMA was limited to CapEx from funds it believed would be available as opposed to CapEx funds it believes are necessary. Similarly, the CapEx projected by LUMA in October 2022 was limited to certain types of CapEx, i.e., the most urgent remediation measures.

(61) It was therefore prudent, in my view, for PREPA to update its CapEx forecasts when deriving the Legacy Charge on the basis of new data or information which was not available at the time the 2022 Fiscal Plan was created and to provide for investments which would replace and improve elements of PREPA's aging T&D and generation systems, notwithstanding CapEx constraints set forth in the 2022 Fiscal Plan. Moreover, given the relatively recent involvement of LUMA, together with PREPA's historical underinvestment in CapEx, it is by no means inconceivable that LUMA would update its future CapEx estimates to ensure it can modernize the T&D system instead of overextending PREPA's financial resources to pay off more legacy debt at the risk of future insolvency or sustained system reliability issues. A failure to secure the remaining cost-share funds could jeopardize PREPA's ability to access said funds.[81]

V.C. The "updated" T&D CapEx forecast proposed by Dr. Tierney does not reflect LUMA's most recent T&D CapEx assumptions

(62) Dr. Tierney alleges that the Oversight Board "…uses a capital cost forecast that is outdated and too high compared to LUMA's latest forecasts."[82] She states further that, "…LUMA has subsequently

[79] "Motion Submitting Fiscal Year 2022 Budget Amendment," Case No. NEPR-MI-2021-0004, June 6, 2022, Table 1-1 [hereinafter "LUMA June 2022 Amendment"]; "Motion Submitting Fiscal Year 2022 Budget Amendment," Case No. NEPR-MI-2021-0004, November 2, 2022, Table 1-1.

[80] LUMA June 2022 Amendment, pp. 3-4

[81] 2022 Fiscal Plan, pp. 90-91; LUMA letter to Proskauer re CapEx (February 7, 2023) (FOMB_PREPA 00023701-704), pp. 1-2.

[82] Tierney Initial Report, Section VIII.A.

updated its forecast for PREPA-funded capital expenditures and provides new forecasts for each fiscal year between 2023 and 2032. The updated LUMA forecasts of such PREPA-funded capital expenditures beyond fiscal year 2025 are markedly lower than PREPA's assumptions in the 2022 PREPA Fiscal Plan and are consistent with LUMA's multi-phase proposed recovery and transformation roadmap."[83]

(63) However, Dr. Tierney misinterprets the so called "updated" forecast from LUMA. The 2022 Fiscal Plan's T&D CapEx forecast was prepared in April 2022, while Dr. Tierney's allegedly updated LUMA forecast appears to have been prepared in October 2022.[84] Based on a discussion with LUMA, I understand that the October 2022 forecast is in fact the same as the forecast that LUMA submitted in April 2022 for the 2022 Fiscal Plan. The primary difference between the two forecasts is that the April 2022 forecast is in *nominal* dollars (not adjusted for inflation) while the October 2022 forecast is in *real* dollars (adjusted for inflation). Thus, the perceived difference between the two forecasts is the effect of inflation compounded over the forecast period. Moreover, the October 2022 forecast prepared by LUMA assumes inflation rates of 2.7%, 1.7%, and 1.6% for FY 2023-2025, respectively.[85] This is significantly lower than the observed year-to-date inflation in FY 2023 and this is likely also to be the case in FY 2024. Accordingly, LUMA's CapEx forecast from the 2022 Fiscal Plan is already understated.

(64) When creating a forecast, it is advisable to use the most recent data available where possible to capture any relevant changes and, as I understand it, the LUMA October 2022 forecast does *not* represent the most recent data. Indeed, LUMA prepared a letter in February 2023 related to the development of the Legacy Charge, which indicated additional CapEx needs above and beyond what had been estimated, and included in the 2022 Fiscal Plan, some ten months previously. This is not unusual, especially in light of the fact that the Legacy Charge will not be up for revision each year, unlike the CapEx forecasts in the annual fiscal plan. Accordingly, I believe it was prudent for the Oversight Board to consider the most recent projections of CapEx needs consistent with LUMA's updated analysis of CapEx requirements as set forth in the February 2023 LUMA CapEx letter when developing the Legacy Charge.

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[83] Tierney Initial Report, ¶ 104.

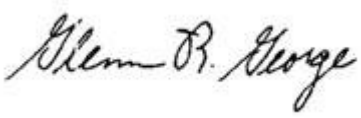
[84] Tierney Initial Report, ¶ 103; "Estimated Non-Federally Funded CAPEX FY2023-2032.xlsx" (FOMB_PREPA 00020150). The metadata from the "Estimated Non-Federally Funded CAPEX FY2023-2032.xlsx" Excel file indicates that the file was created October 10, 2022, and last modified on October 13, 2022.

[85] LUMA Submission of Annual Budget, April 2, 2022 (FOMB_PREPA 00020540-21007), p. 23.

V.D. Extracting the maximum conceivable revenue from PREPA's customers would be imprudent and, by potentially shortchanging CapEx, could threaten PREPA's sustainability as a going concern

(65) In adopting the Alternative Forecast, Dr. Tierney implicitly assumes that the Alternative Forecast will exceed the load projected in the Base Case. This would suggest the need to invest in new generation capacity in 2028, since the AES coal plant is scheduled to shut down at that time. Yet Dr. Tierney makes no additional allowances for CapEx required to replace the AES coal plant. This is but one example of a future CapEx need which must eventually be met in the Alternative Forecast. If PREPA overly constrains itself by prioritizing debt repayment and enforcing an even higher Legacy Charge, this may preclude it from being able to raise rates in future for CapEx investments, natural disaster recovery, or escalating fuel prices.

(66) The asymmetric risk associated with over-extracting revenue from PREPA's customers also applies to underinvestment in CapEx. If PREPA could not adequately invest in upgrades and make its generation and T&D systems more resilient and reliable, it would be unable to provide reliable service to its customers or, indeed, to maintain its operations as a going concern.



Glenn R. George

5/15/23

Date

Appendix A. Additional documents considered or relied upon

Only documents not previously cited in the George Initial Report are included here.

A.1. Documents and data with Bates numbers

- "Estimated Non-Federally Funded CAPEX FY2023-2032.xlsx" (FOMB_PREPA 00020150).

A.2. Publicly available documents

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- "LUMA's Proposed EV Infrastructure Is Subject of Hearing before PREB Today*," San Juan Daily Star*, June 15, 2022, https://www.sanjuandailystar.com/post/luma-s-proposed-ev-infrastructure-is-subject-of-hearing-before-preb-today#:~:text=In%202021%2C%20the%20number%20of,%25%2C%20according%20to%20the%20document.
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A.3. Expert reports

- Expert report of Glenn R. George, MBA, PE, PhD, April 28, 2023.
- Expert report of Maureen M. Chakraborty, PhD, April 28, 2023.

- Expert report of Susan Tierney, PhD, April 28, 2023.

A.4. Other data and statistics

- "20230512 Utility Benchmark PREPA CapEx.xlsx," McKinsey & Company, May 12, 2023.